Open-File Report 84-525

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR SELECTED SITES, FEBRUARY 15 THROUGH APRIL 9, 1984, NEAR THE Y-12 PLANT, THE OAK RIDGE RESERVATION, TENNESSEE

R. D. Evaldi

U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
U.S. DEPARTMENT OF ENERGY

Knoxville, Tennessee
1984

UNITED STATES DEPARTMENT OF THE INTERIOR

WILLIAM P. CLARK, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey
A-413 Federal Bldg.
Nashville, TN 37203

Copies of this report can be purchased from:

Open-File Services Section
U.S. Geological Survey
Box 25425, Federal Center
Lakewood, CO 80225
(Telephone: 303/ 236-7476)

CONTENTS

	Page
Abstract	1
Introduction	1
Description of the area	1
Discharge	3
Specific conductance	3
References	5

ILLUSTRATIONS

Figure 1. Map showing location of the study area 2

PLATES

Plate 1. Map showing measured discharge at selected sites in 18 watersheds near the Y-12 Plant, February 15 through April 9, 1984 . . . . . in pocket

2. Map showing specific conductance at selected sites in 18 watersheds near the Y-12 Plant, February 15 through April 9, 1984 . . . . . in pocket

TABLES

Table 1. Noon discharge of Bear Creek at Highway 95, February 15 through April 9, 1984 4

FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM OF UNITS (SI)

Multiply	by	To obtain
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
foot (ft)	0.3048	meter (m)
acre	0.4047	square hectometer (hm^2)
square mile (mi^2)	2.590	square kilometer (km^2)
mile (mi)	1.609	kilometer (km)

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR SELECTED SITES, FEBRUARY 15 THROUGH APRIL 9, 1984, NEAR THE Y-12 PLANT, THE OAK RIDGE RESERVATION, TENNESSEE

R. D. Evaldi

ABSTRACT

Discharge and specific conductance were measured February 15 through April 9, 1984 during base flow of streams in 18 watersheds in the vicinity of the Y-12 Plant of the Oak Ridge Reservation, Tennessee. Discharge of springs and streams measured at specific sites ranged from 0 to 16 cubic feet per second. Specific conductance ranged from 23 to 6,300 micromhos per centimeter. During the days of instantaneous discharge measurements, flow of Bear Creek at the continuous-record station at Highway 95 near Oak Ridge ranged from 3.6 to 17 cubic feet per second.

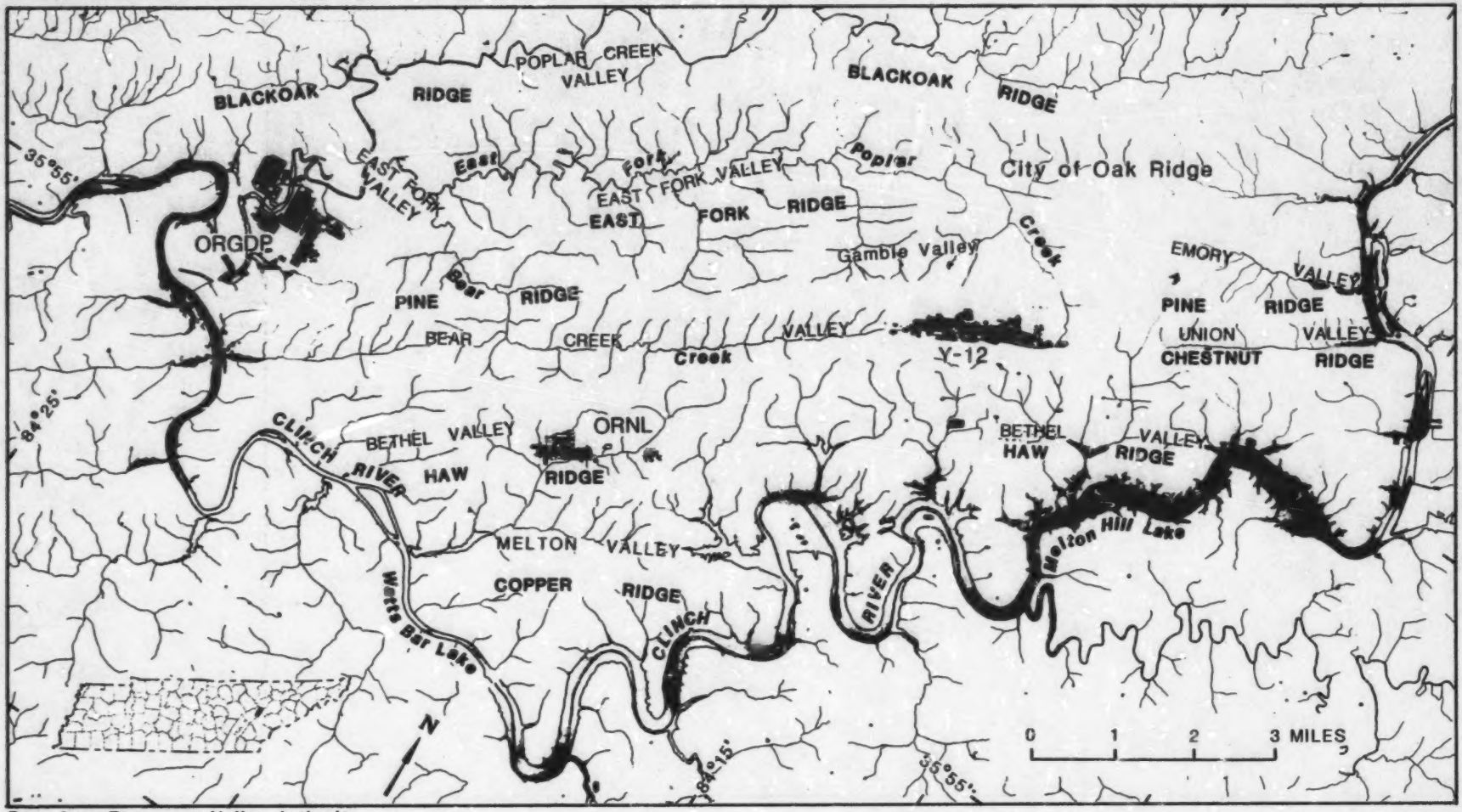
INTRODUCTION

Discharge and specific conductance were measured February 15 through April 9, 1984, by the U.S. Geological Survey in 18 watersheds near the Y-12 Plant at the Oak Ridge Reservation, Tenn. (fig. 1). The watersheds range in size from 0.10 to 5.92 mi^2. Discharge was measured during base flow at 241 sites to identify gains and losses of flow along channels. Because specific conductance data can be used to estimate dissolved-solids concentrations in water, specific conductance was measured at 259 sites to help identify locations of ground-water discharge to the streams and to select sites where more comprehensive water-quality data were needed. This data collection is part of a study, in cooperation with the Department of Energy, to describe the regional ground-water flow system and to determine the extent of any effects on ground water resulting from activities at the Y-12 Plant.

DESCRIPTION OF THE AREA

The Oak Ridge Reservation includes 58,000 acres in the west-central part of East Tennessee, and is bounded on the northeast, southeast, and southwest by the Clinch River, and on the northwest by Blackoak Ridge (McMaster, 1967, p. N2). The three major facilities in the area are X-10, the Oak Ridge National Laboratory (ORNL), a research and development center; Y-12, a research, development, and production center; and the K-25 Gaseous Diffusion Plant (ORGDP), a production facility (fig. 1).

The Oak Ridge reservation is in the Valley and Ridge physiographic province (Miller, 1974). Ordovician and Cambrian rocks that underlie the Valley and Ridge are predominately carbonate rocks, siltstone, shale, and some sandstone. Northeast-trending ridges, generally at altitudes of 1,000 to 1,200 feet, are formed by rocks that are resistant to weathering such as



Base from Tennessee Valley Authority
1:24,000 map S-16A, revised in part June 1974

Figure 1.--Study area.

the sandstone and shale of the Rome Formation or by chert-rich residuum of the Knox Group. The valleys, generally flat and at altitudes of 750 to 850 feet, are underlain by less resistant rocks such as the shale in the Conasauga Group or the limestone and shale in the Chickamauga Group.

DISCHARGE

Discharge, measured during periods of base flow at 209 sites along streams and at 32 springs, ranged from 0 to 16 ft^3/s (pl. 1). Water in the streams was assumed to be largely from ground water rather than from surface runoff. Flow decreased in a downstream direction in several channel reaches; some reaches were dry. Discharge is reported to the nearest hundredth for flows of less than 1 ft^3/s; to tenths between 1.0 and 9.9 ft^3/s; and to whole numbers above 10 ft^3/s. Measurements were made with current meters and the measurement error was estimated to be within 10 percent.

The discharge of Bear Creek is measured at a continuous-record station at Highway 95 (pl. 1) by Martin Marietta Energy Systems, Inc. as part of the National Pollution Discharge Elimination System. Discharges of Bear Creek computed from noon records for February 15 through April 9, 1984 (table 1) were used as an indication of the magnitude of runoff for the days that the streamflow measurements were made. Measurements of instantaneous discharge at specific sites in a given watershed were made in 1 day except those in watershed No. 1, which were made February 15 and 16. To determine base flow during February 15 and 16, the instantaneous discharge measurements were adjusted to an estimated value for midnight February 15, 1984 based on the streamflow recession rate. The adjustments were needed to minimize effects of overland runoff from precipitation on February 13.

SPECIFIC CONDUCTANCE

Specific conductance, measured at 227 sites along streams and at 32 springs, ranged from 23 to 6,300 micromhos per centimeter (pl. 2). Specific conductance can be used to approximate the dissolved-solids concentration in the water. Commonly, the concentration of dissolved solids, in milligrams per liter, is about 65 percent of the specific conductance, in micromhos (Hem, 1970, p. 99). However, this relation is not constant from stream to stream, and may vary in the same stream with changes in the composition of the water.

Table 1.--Noon discharge of Bear Creek at Highway 95, February 15 through April 9, 1984.

[Data furnished by Martin Marietta Energy Systems, Inc.]

Date	Discharge (ft^3/s)	Date	Discharge (ft^3/s)	Date	Discharge (ft^3/s)
Feb. 15	17	Mar. 4	7.9	Mar. 22	22
16	13	5	7.5	23	16
17	10	6	8.3	24	13
18	9.1	7	6.8	25	12
19	7.5	8	6.6	26	9.8
20	6.9	9	5.7	27	8.4
21	6.1	10	5.5	28	61
22	5.2	11	5.4	29	31
23	6.9	12	4.9	30	20
24	6.1	13	5.1	Mar. 31	15
25	5.6	14	4.3	Apr. 1	12
26	5.0	15	3.6	2	10
27	24	16	6.1	3	10
28	22	17	6.0	4	52
Feb. 29	15	18	6.1	5	24
Mar. 1	12	19	6.1	6	15
2	10	20	6.6	7	12
Mar. 3	8.7	Mar. 21	34	8	11
				Apr. 9	10

REFERENCES

Hem, J. D., 1970, Study and interpretation of the chemical characteristics of natural water, 2nd ed.: U.S. Geological Survey Water-Supply Paper 1473, 363 p.

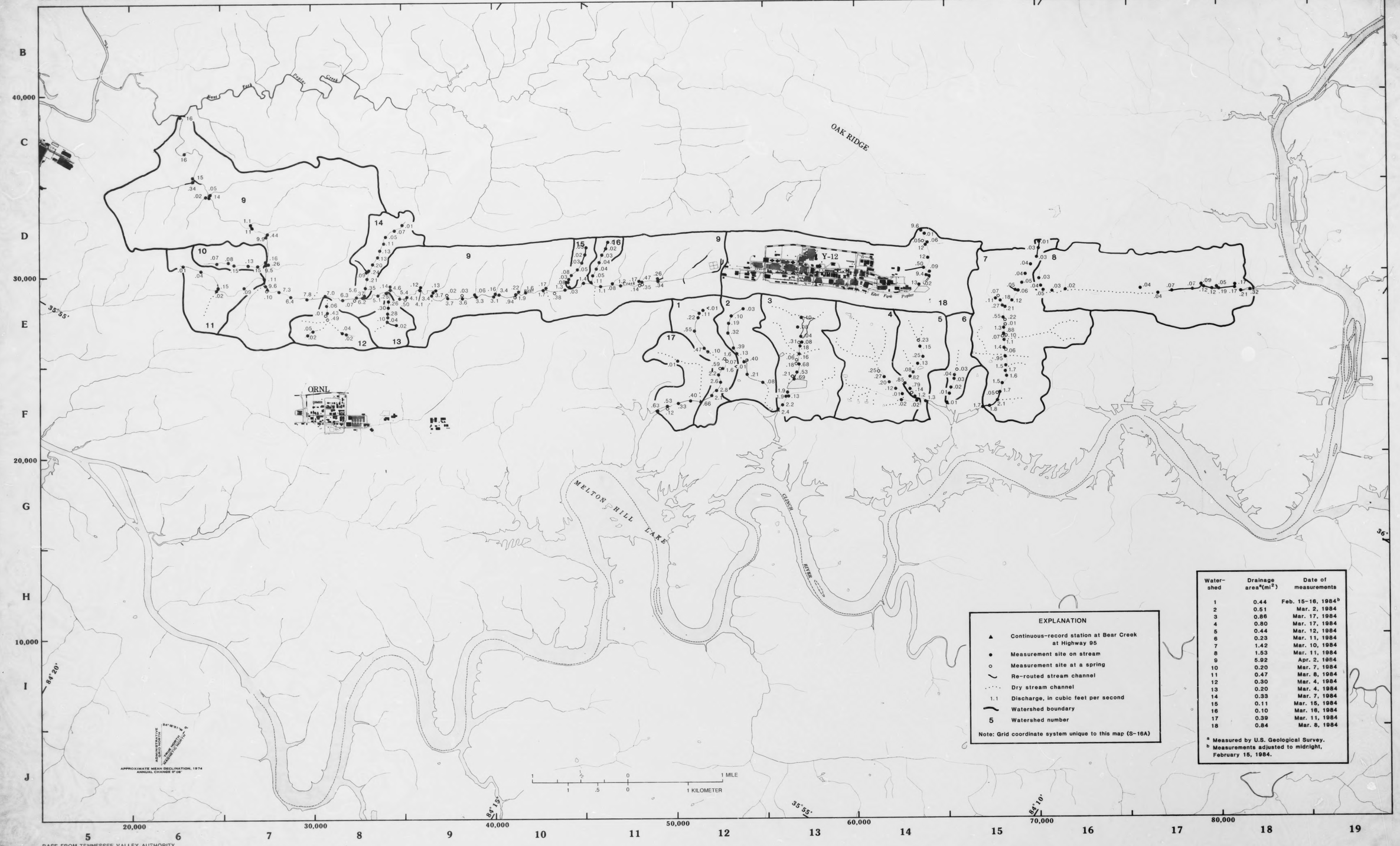
McMaster, W. M., 1967, Hydrologic data for the Oak Ridge area Tennessee: U.S. Geological Survey Water-Supply Paper 1839-N, 60 p.

Miller, R. A., 1974, The geologic history of Tennessee: Tennessee Division of Geology Bulletin 74, 63 p.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Prepared in cooperation with the
UNITED STATES DEPARTMENT OF ENERGY

OPEN-FILE REPORT 84-625
PLATE 1



EXPLANATION

- ▲ Continuous-record station at Bear Creek at Highway 95
- • Measurement site on stream
- ○ Measurement site at a spring
- Re-routed stream channel
- ····· Dry stream channel
- 1.1 Discharge, in cubic feet per second
- Watershed boundary
- 5 Watershed number

Note: Grid coordinate system unique to this map (S-16A)

Watershed	Drainage area[a] (mi^2)	Date of measurements
1	0.44	Feb. 15-16, 1984[b]
2	0.51	Mar. 2, 1984
3	0.86	Mar. 17, 1984
4	0.80	Mar. 17, 1984
5	0.44	Mar. 12, 1984
6	0.23	Mar. 11, 1984
7	1.42	Mar. 10, 1984
8	1.53	Mar. 11, 1984
9	5.92	Apr. 2, 1984
10	0.20	Mar. 7, 1984
11	0.47	Mar. 8, 1984
12	0.30	Mar. 4, 1984
13	0.20	Mar. 4, 1984
14	0.33	Mar. 7, 1984
15	0.11	Mar. 15, 1984
16	0.10	Mar. 16, 1984
17	0.39	Mar. 11, 1984
18	0.84	Mar. 8, 1984

[a] Measured by U.S. Geological Survey.
[b] Measurements adjusted to midnight, February 15, 1984.

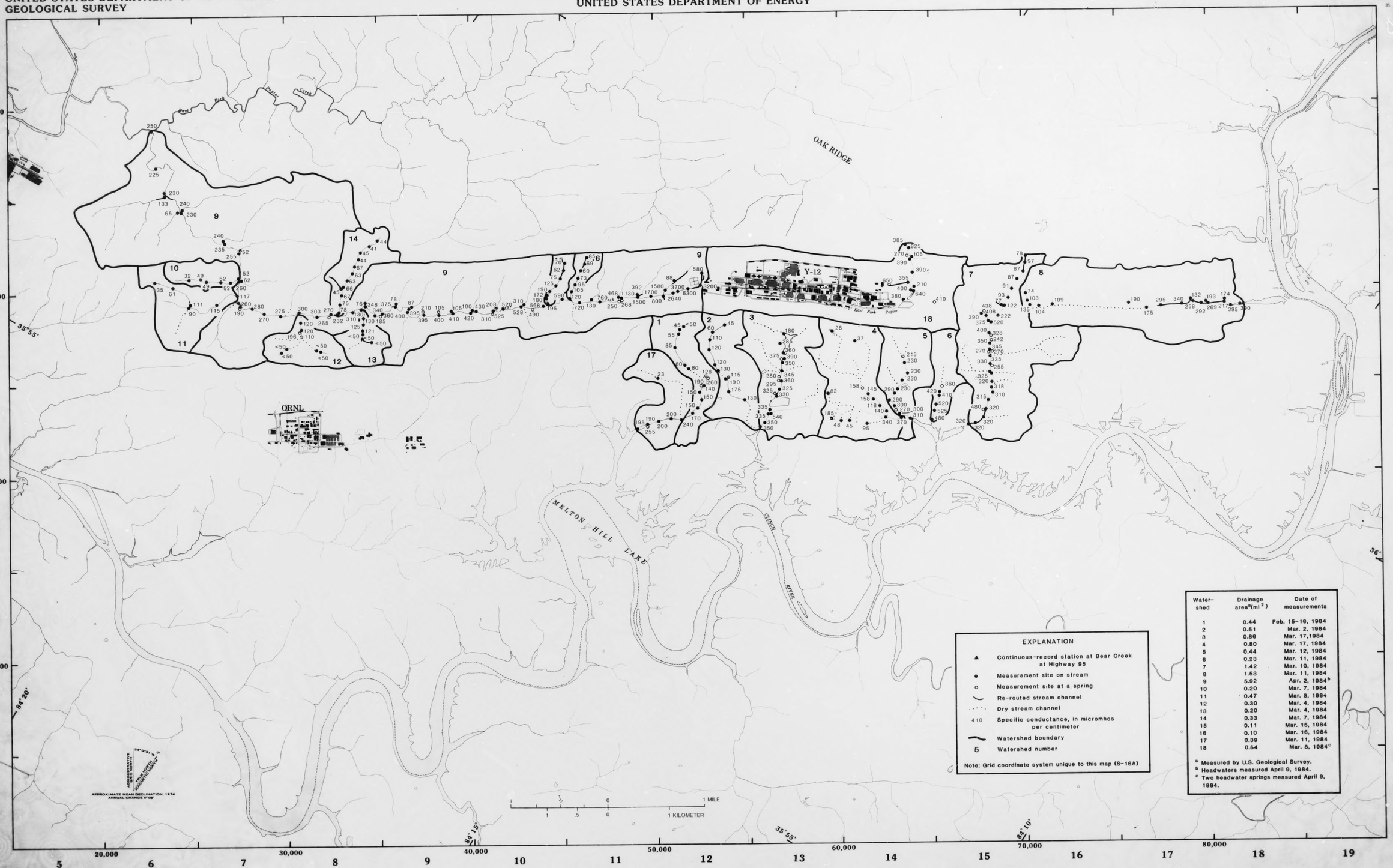
BASE FROM TENNESSEE VALLEY AUTHORITY
BETHEL VALLEY, CAVE CREEK, CLINTON, ELVERTON,
LENOIR CITY, LOVELL, AND WINDROCK, 1968
REVISED IN PART IN JUNE 1974

MEASURED DISCHARGE AT SELECTED SITES IN 18 WATERSHEDS NEAR Y-12 PLANT, FEBRUARY 15 THROUGH APRIL 9, 1984.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Prepared in cooperation with the
UNITED STATES DEPARTMENT OF ENERGY

OPEN-FILE REPORT 84-625
PLATE 2



Watershed	Drainage area[a] (mi^2)	Date of measurements
1	0.44	Feb. 15–16, 1984
2	0.51	Mar. 2, 1984
3	0.86	Mar. 17,1984
4	0.80	Mar. 17, 1984
5	0.44	Mar. 12, 1984
6	0.23	Mar. 11, 1984
7	1.42	Mar. 10, 1984
8	1.53	Mar. 11, 1984
9	5.92	Apr. 2, 1984[b]
10	0.20	Mar. 7, 1984
11	0.47	Mar. 8, 1984
12	0.30	Mar. 4, 1984
13	0.20	Mar. 4, 1984
14	0.33	Mar. 7, 1984
15	0.11	Mar. 15, 1984
16	0.10	Mar. 16, 1984
17	0.39	Mar. 11, 1984
18	0.64	Mar. 8, 1984[c]

[a] Measured by U.S. Geological Survey.
[b] Headwaters measured April 9, 1984.
[c] Two headwater springs measured April 9, 1984.

BASE FROM TENNESSEE VALLEY AUTHORITY
BETHEL VALLEY, CAVE CREEK, CLINTON, ELVERTON, LENOIR CITY, LOVELL, AND WINDROCK, 1968
REVISED IN PART IN JUNE 1974

SPECIFIC CONDUCTANCE AT SELECTED SITES IN 18 WATERSHEDS NEAR Y-12 PLANT, FEBRUARY 15 THROUGH APRIL 9, 1984.